

Essential Elements

| | | |
|---------------|---------------------------------------|--|
| Bulk Elements | required by the body in large amounts | Oxygen Carbon Hydrogen Nitrogen Phosphorus Sulfur |
|---------------|---------------------------------------|--|

| | | |
|----------------|---------------------------|--------------------------|
| Trace Elements | required in small amounts | Copper Iodine Iron |
|----------------|---------------------------|--------------------------|

| | | |
|---------------------|--------------------------------|--|
| Ultratrace Elements | required in very small amounts | Arsenic Boron Nickel Silicon Tin |
|---------------------|--------------------------------|--|

Principle Elements in the Human Body

| Element | % of Body Weight | Function |
|---------|------------------|----------|
|---------|------------------|----------|

| | | |
|------------|-----|---|
| Oxygen (O) | 65% | Component of water, essential for respiration |
|------------|-----|---|

| | | |
|------------|-------|--------------------------------|
| Carbon (C) | 18.6% | Found in all organic molecules |
|------------|-------|--------------------------------|

Principle Elements in the Human Body (cont)

| | | |
|--------------|------|--|
| Hydrogen (H) | 9.7% | Component of water and most compound in the body |
|--------------|------|--|

| | | |
|--------------|------|-------------------------------------|
| Nitrogen (N) | 3.2% | Found in proteins and nucleic acids |
|--------------|------|-------------------------------------|

| | | |
|--------------|------|--|
| Calcium (Ca) | 1.8% | Found in bones and teeth, needed for nerves and muscle contraction, blood clotting |
|--------------|------|--|

| | | |
|----------------|----|----------------------------|
| Phosphorus (P) | 1% | Found in bones, teeth, ATP |
|----------------|----|----------------------------|

| | | |
|---------------|------|--|
| Potassium (K) | 0.4% | Necessary for membrane function, nerve impulses, and muscle contractions |
|---------------|------|--|

| | | |
|-------------|------|--|
| Sodium (Na) | 0.2% | Necessary for membrane function, nerve impulses, and muscle contractions |
|-------------|------|--|

Principle Elements in the Human Body (cont)

| | | |
|---------------|------|---|
| Chlorine (Cl) | 0.2% | Important for membrane function and water absorption, major component of stomach acid |
|---------------|------|---|

| | | |
|------------|-------|------------------------|
| Sulfur (S) | 0.04% | Found in many proteins |
|------------|-------|------------------------|

| | | |
|-----------|--------|--------------------------------|
| Iron (Fe) | 0.007% | Essential for oxygen transport |
|-----------|--------|--------------------------------|

| | | |
|------------|---------|--|
| Iodine (I) | 0.0002% | Component of hormones of the thyroid gland |
|------------|---------|--|

Ions

| Name | Chemical Symbol |
|------|-----------------|
|------|-----------------|

| | |
|--------|-----------------|
| Sodium | Na ⁺ |
|--------|-----------------|

| | |
|-----------|----------------|
| Potassium | K ⁺ |
|-----------|----------------|

| | |
|---------|------------------|
| Calcium | Ca ²⁺ |
|---------|------------------|

| | |
|----------|-----------------|
| Chlorine | Cl ⁻ |
|----------|-----------------|

| | |
|-------------|-------------------------------|
| Bicarbonate | HCO ₃ ⁻ |
|-------------|-------------------------------|



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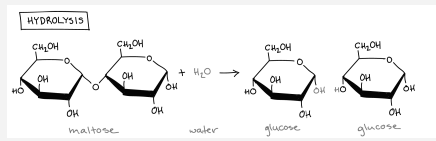
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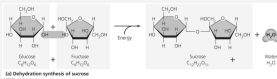
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Catabolism



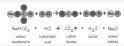
Catabolism (Decomposition): breaks molecules into smaller fragments

Anabolism



Anabolism (Synthesis): assembles larger molecules from smaller ones

Exchange Reactions



Exchange Reactions (replacement): reacting molecules are rearranged

Reversible Reaction



Inorganic vs Organic Molecules

| Inorganic | Organic |
|--|---|
| No C and H together | Contain C and H |
| Smaller molecules | Larger molecules |
| Dissociate in water | Dissolve in water |
| Water, oxygen, carbon dioxide, and salts | Carbohydrates, lipids, proteins and nucleic acids |

Organic Building Blocks



Carbohydrates

Contains C, H, and O (often end in the suffix "-ose")

1:2:1 ratio

Monosaccharides and Disaccharides

(simple sugars): provide energy

- Monosaccharide examples: glucose, fructose, galactose
- Disaccharide examples: sucrose, maltose, lactose

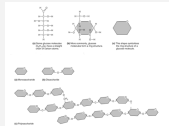
Polysaccharides: store glucose

- Examples: glycogen (in liver and muscle)

Glycoproteins and Glycolipids: on cell surfaces, aid in cell communication and recognition (ID tags)

- ex. MHC proteins, T-cell receptors, blood type

Carbohydrate Structures



Triglycerides

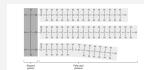
Functions:

- Used primarily for energy storage
- More energy rich than glucose
- Cushions and insulates the body and nerves (myelin sheath)

Structure:

- Made of 1 glycerol and 3 fatty acids
- Saturated fats contain three saturated fatty acids
- Saturated = all single C to C bonds (saturated in hydrogen)
- Mostly solid and come from animals
- Unsaturated fats contain at least one unsaturated fatty acid
- Unsaturated = at least one double C to C bond (causes kinks in the chain)
- Mostly liquid and come from plants

Triglyceride Structure



The first two fatty acid chains are saturated while the third fatty acid chain is unsaturated

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Phospholipids

Function:

- Major component of cell membranes
- Helps provide selective permeability (water barrier)

Structure:

- Made of 1 glycerol, 2 fatty acids, and 1 phosphate
- Hydrophilic head and hydrophobic tails (amphipathic)

Phospholipid Structure



Steroids

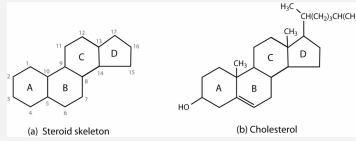
Function:

- Synthesize sex hormones
- Cholesterol: Needed for vitamin D and bile production
 - HDL "good kind" goes to the liver
 - LDL "bad kind" gets deposited on artery walls

Structure:

- Four connected rings of carbon, hydrophobic

Steroid Structure



Proteins

Functions:

- Structure and support: muscle, ligaments, fingernails, hair, skin
- Last resort energy source
- Hormones
- Receptors
- Antibodies
- Enzymes

Structure:

- Made of amino acids (20 in human body)
- Amine group, carboxyl group, variable R group
- Amino acids held together with peptide bonds
- Must have specific shape to function correctly

Protein Structure



Nucleic Acids

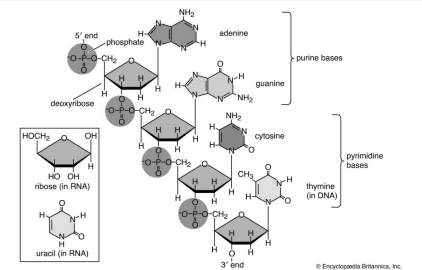
Function:

- DNA (deoxyribonucleic acid): encodes genetic information
- Provides instructions for making proteins
- RNA (ribonucleic acid): helps decode DNA

Structure:

- Contains the elements CHONP
- Made of nucleotides

Nucleic Acid Structure



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